## REMARKS

Examiner Heitbrink is thanked for the courtesy of a telephone interview with the Applicant, Griffith Neal, and his below signed attorney, on June 30 and July 21, 2004. In addition to the information contained in the Examiner's Interview Summary mailed July 2, 2004, the following is noted. While all of the claims were discussed generally, claims 1, 18, 32, 33, 34, 45, 58, 59, 73, 74 and 75 were discussed with more particularity. U.S. Patent No. 5,650,896 (Viskochil) and the Injection Molding Handbook (Rosato) were discussed. In addition, the Examiner mentioned that some patents (numbers unspecified) to Kazmer et al. were relevant. Applicant conducted a search for Kazmer patents and found several. The relevant patents identified by Applicant are listed on in the accompanying Information Disclosure Statement, but were not discussed with any specificity during the interview. Two sets of proposed claim amendments were sent by e-mail to the Examiner, one set prior to each day covered by the interview. Attached hereto is a copy of the first set of proposed claims sent to the Examiner and discussed on June 30. The proposed amended set of claims for the July 21 portion of the interview are identical (with one minor exception in claim 15) to the above amended claim set. Arguments presented during the interview are included in the remarks below. The foregoing drawing amendments were also discussed, as was the fact that an Information Disclosure Statement would be filed. Agreement was reached that the proposed claims would likely obviate the Section 112 rejections. No other agreement was reached.

In the specification, the paragraphs on pages 24 and 25 were amended to correct minor typographical errors. The drawings were amended to make them suitable as formal drawings. Many of the claims were reworded and new claims 76-85 were added. The reworded claims and new claims are supported by the original specification as filed. No new matter is involved in these amendments.

In the outstanding Office Action, claims 18-20, 40-42, 53-55 and 67-69 were rejected under 35 U.S.C. § 112, first paragraph, and claims 45 and 60 were rejected under 35 U.S.C. § 112, second paragraph as indefinite. In addition, claims 58, 59 and 73 were objected to under 37 C.F.R. § 1.75 as being duplicative. The forgoing amendments to these claims overcomes these rejections and objection.

In the outstanding Office Action, claims 32 and 33 were rejected under the judicially created doctrine of double patenting over claims of the following three U.S. patents to Applicant: 6,437,464; 6,617,721 and 6,501,616. While not explicit, it appears that these are "obviousness-type" double patenting rejections. These rejections are respectfully traversed. While the Applicant's earlier patents disclose substantial encapsulation of hard disc drive and other electrical components, none of the three referenced patents disclose that by controlling the molding parameters as required by claim 1, a plurality of hard disc drive components could be made each having a substantially uniform resonance spectrum, as required by claims 32 and 33. Thus the invention of claims 32 and 33 would not have been obvious in view of the disclosures of the Applicant's earlier patents.

In the outstanding Office Action, claims 1-26 and 28-75 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,650,896 (Viskochil) in view of the Injection Molding Handbook (Rosato). In addition, claim 27 was rejected in the outstanding Office Action under 35 U.S.C. § 103(a) as being unpatentable over Viskochil in view of Rosato and further in view of U.S. Patent No. 5,966,799 (Understiller). These rejections are respectfully traversed.

The present invention relates to a method of making hard disc drives, hard disc drive components and other electrical components having a more uniform and predictable, and in some cases modified, resonance spectrum. Claim 1 is directed a method for injection molding a layer of phase change material around a surface of a hard disc drive component. The claim calls for the following steps: providing a hard disc drive component; placing the hard disc drive component in a mold cavity of an injection molding machine having a controllable fill rate and a controllable injection pressure; closing the mold cavity; injecting a molten phase change material into the mold cavity; monitoring pressures at a plurality of points in the mold cavity during the injection of the molten phase change material; and using the monitored pressures and a controller to control the fill of the molten phase change material during injection in a manner that attempts to duplicate a predetermined time-pressure curve for each of the plurality of points in the mold, to thereby obtain the hard disc drive component with the phase change material thereon.

While Viskochil discloses an overmolded voice coil actuator for use in a hard disk drive, as acknowledged by the Office Action, the reference only teaches conventional injection molding operations. The focus of the molding in Viskochil is directed to the dimensions and size of the parts, and does not disclose or suggest that the bulk physical properties of the part, which impact on the part's resonance spectrum, can or even should be controlled or modified to produce parts with a uniform resonance spectrum.

Rosato makes no mention of overmolding components such as electrical components or hard disc drive components. Rosato only describes the use of molding process controls to create parts with uniform size and surface appearance. Whether such processes could or should be used in molding parts like those described in Viskochil is never addressed in Rosato. Moreover, Rosato makes no mention of control of the molding operation as a way to make parts of a uniform resonance, nor even of controlling the molding operation to effect bulk physical properties like tensile strength, tensile modulus and dampening ratio, which affect the resonance. Thus, even if the control steps of Rosato were used to mold the parts disclosed by Viskochil, the present invention would not have been obvious, and involves unexpected results.

Claim 1 specifically calls for monitoring pressures at a plurality of points in the mold cavity during the injection of the molten phase change material; and using the monitored pressures and a controller to control the fill of the molten phase change material during injection in a manner that attempts to duplicate a predetermined time-pressure curve for each of the plurality of points in the mold. It has been found that controlling the fill is important in order to obtain a uniform density gradient, and hence a uniform resonance spectrum. While Rosato suggests that cavity pressures be monitored while a molding operation is being developed for a new part, there is no suggestion of monitoring pressures at a plurality of points in the mold cavity during the injection of the molten phase change material; and using the monitored pressures and a controller to control the fill of the molten phase change material during injection in a manner that attempts to duplicate a predetermined time-pressure curve for each of the plurality of points in the mold during subsequent molding operations. Claim 46 includes

the same last two steps as claim 1, but applied to motor components. Thus these claims are patentable over the cited references.

Claim 34 is directed to a method of manufacturing hard disc drives having a reproducible resonance spectrum. The process steps include providing a plurality of identical hard disc drive component sets, wherein each of the sets consists of components that are used in a single hard disc drive; placing and positioning one of the plurality of hard disc drive component sets in a mold cavity of an injection molding machine; closing the mold cavity; monitoring the pressure inside the mold cavity; injecting a molten phase change material into the mold cavity to a pre-determined cavity pressure gradient; and repeating the steps to produce a plurality of hard disc drives each having a substantially uniform resonance spectrum. The cited prior art does not disclose injecting a molten phase change material into a mold cavity to a pre-determined cavity pressure gradient. Thus claim 34, and new claim 76 which is patterned after claim 34 but relates to making motors with a substantially uniform resonance spectrum, are patentable over the cited prior art.

Claim 60 is directed to a method of reducing sympathetic resonances of a component in a hard disc drive. The specification, on page 2, explains how a component of a hard disc drive, if it has a resonance at the wrong frequency, can have sympathetic vibrations. "Sometimes a particular frequency of vibration in one part can couple with the resonate frequency of another part creating a node of energy that is undesirable." The steps of claim 60 call for providing a hard disc drive component; determining a desired resonance spectrum of frequencies to avoid for the hard disc drive component; placing the hard disc drive component in a mold cavity of an injection molding machine having a controllable fill rate and a controllable injection pressure; closing the mold cavity; injecting a molten phase change material into the mold cavity; monitoring and controlling the pressure in the mold cavity; and monitoring and controlling one or more of the fill rate of the molten phase change material and injection pressure to obtain the hard disc drive component with the phase change material thereon, having the desired resonance spectrum. The cited prior art does not even recognize that by changing the molding parameters one can change the resonance frequency of a part. Certainly the cited prior art does not disclose or suggest the

claimed method of determining a desired resonance spectrum of frequencies to avoid and monitoring and controlling the fill rate, injection pressure or both to produce a part with the desired resonance spectrum. Claim 60 is thus patentable over the cited references.

Claim 62 is similar to claim 60 in that it also calls for the steps of monitoring and controlling the pressure in the mold cavity; and monitoring and controlling one or more of the fill rate of the molten phase change material and injection pressure, but the claim is directed to producing a plurality of identical hard disc drive components, and the steps of monitoring and controlling are used to produce a plurality of components each having a substantially uniform resonance spectrum. Since the cited art does not recognize that by changing the molding parameters one can change the resonance frequency of a part, it does not disclose or suggest the claimed method of monitoring and controlling the pressure in the mold cavity; and monitoring and controlling one or more of the fill rate of the molten phase change material and injection pressure to produce a plurality of components each having a substantially uniform resonance spectrum.

Claim 74 is directed to a method of injection molding hard disc drive components having a reproducible resonance spectrum. The claim calls for providing at least one hundred identical hard disc drive components; and over-molding a monolithic body of phase change material on a surface of the hard disc drive components using an injection molding process, wherein the components with a phase change material thereon have a median first order frequency and wherein each of the at least one hundred hard disc drive components with a phase change material thereon has a first order frequency that is within about one hundred Hertz of the median first order frequency. As explained during the interview, and as taught on pages 25 and 26 of the specification and reflected in Figure 10, the methods of the present invention can make encapsulated voice coil motors with such a uniform resonance spectrum that the standard deviation for a group of parts is in the range of about 20 to 30 Hertz. However, as recited on page 27 of the specification, conventional molding operations yielded voice coil assemblies that have a standard deviation resonance spectrum that is about 300 Hertz, which is well outside the range called for by claim 74. The cited prior art

does not suggest methods to make parts with a substantial uniform resonance spectrum, and therefore would not teach or suggest methods that could produce at least one hundred hard disc drive components where each of the parts has a first order frequency that is within about one hundred Hertz of the median first order frequency of the group of parts. Therefore claim 74 is patentable over the cited references.

Claim 75 is directed to a method of injection molding hard disc drive components having a reproducible resonance spectrum. The steps of the claim call for providing at least one hundred identical hard disc drive components, wherein each of the components has a resonance spectrum; and over-molding a monolithic body of phase change material on a surface of the hard disc drive components using an injection molding process, wherein the resonance spectra of the at least one hundred hard disc drive components with phase change material thereon have a standard deviation of first order resonance frequency that is at least about fifty percent less than the standard deviation of first order resonance frequency for the same number of the same components over-molded with an injection molding process wherein only injection pressure and either injection time or stroke of an extrusion screw are controlled. As noted above, the cited prior art does not suggest methods to make parts with a substantial uniform resonance spectrum, and therefore would not teach or suggest methods that could produce at least one hundred hard disc drive components having a standard deviation of first order resonance frequency that is at least about fifty percent less than the standard deviation of first order resonance frequency for the same number of the same components over-molded with an injection molding process wherein only injection pressure and either injection time or stroke of an extrusion screw are controlled.

New claim 82 is directed to a method for injection molding a layer of phase change material around a surface of a component for an electrical device. The claim calls for placing the component in a mold cavity of an injection molding machine; closing the mold cavity; injecting a molten thermoplastic polymer which exhibits non-Newtonian rheology into the mold cavity; monitoring the effective viscosity of the polymer and controlling the injection rate of the polymer to control the apparent viscosity of the polymer and thus compensate for changes of viscosity due to intrinsic factors in the

polymer to obtain a desired viscosity, and thereby produce the component with the phase change material thereon. As noted on page 3 of the specification, the variations in the intrinsic factors in polymers from one lot to the next may cause a variance in the viscosity by 60 percent from lot to lot. These variations, along with variations from molding operations, result in parts that do not have a substantially uniform resonance spectrum. The method of claim 82 calls for monitoring the effective viscosity and controlling the injection rate of the polymer to compensate for changes in viscosity. Such a process is not taught or suggested by the cited art.

The remainder of the rejected claims are dependent on one of the foregoing independent claims. They are patentable over the cited references for at least the reasons why the independent claim on which they depend are patentable.

Since each of the rejections has been overcome, an early notice of allowance is respectfully requested.

Respectfully submitted,

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Proposed claim amendments and claims for discussion during telephone interview on June 30, 2004

Serial No.: 09/983,002

1. (Currently amended) A method for injection molding a layer of phase change material around a surface of [[each of]] a [[plurality of identical]] hard disc drive [[components]] component comprising:

a) providing a [[plurality of identical]] hard disc drive [[components]] component ;

b) placing [[one of]] said [[plurality of identical]] hard disc drive [[components]] component in a mold cavity of an injection molding machine having a controllable fill rate and a controllable injection pressure;

c) closing said mold cavity;

d) injecting a molten phase change material into said mold cavity at fill rates and injection pressures;

e) monitoring and controlling pressure in the mold cavity during the injection of the molten phase change material; and

f) controlling the fill [[rate]] of said molten phase change material during the injection of the molten phase change using a valve gate to obtain said hard disc drive component with the phase change material thereon[[; and

g) repeating steps b)-f) to produce said plurality of components each having a substantially uniform resonance spectrum]].

1a. (New) The method of claim 1 wherein the step of controlling the fill comprises controlling the fill rate of molten phase change material using said valve gate.

1b. (New) The method of claim 1 wherein the step of controlling the fill comprises controlling the amount of molten phase change material injected using said valve gate.

1c. (New) The method of claim 1 wherein the step of controlling the fill comprises closing said valve gate when a predetermined mold cavity pressure is reached.

2. (Currently amended) The method of claim 1 wherein the pressure is monitored at [[a runner to the mold cavity,]] a beginning-of-fill point and an end-of-fill point.

14. (Currently amended) The method of claim [[13]] 1 wherein [[the]] a controller starts and stops the flow of molten material into said cavity by opening and closing [[a]] said valve gate [[associated with said cavity]].

18. (Currently amended)(needs further revision) The method of claim 1 wherein said plurality of said hard disc drive components comprise at least one hundred components with phase change material thereon, said at least one hundred components having a median first order frequency and wherein each of said at least one hundred hard disc drive components with a phase change material thereon has a first order frequency that is within about three hundred Hertz of said median first order frequency.

32. (Currently amended) A plurality of hard disc drive [[component]] components made by the method of claim 1 each having a substantially uniform resonance spectrum.

33. (Currently amended) [[An]] A plurality of electronic [[device]] devices each comprising at least one of the plurality of the hard disc drive [[component]] components of claim 32.

34. (Currently amended) A method of manufacturing hard disc drives having a reproducible resonance spectrum comprising:

a. providing a plurality of identical hard disc drive component sets, wherein each of said sets consists of components that are used in a single hard disc drive;

b. placing and positioning one of said plurality of hard disc drive component sets in a mold cavity of an injection molding machine;

c) closing said mold cavity;

d) monitoring the pressure inside the mold cavity [[at an end-of-fill point]];

e) injecting a molten phase change material into said mold cavity to a pre-determined [[set point]] <u>cavity</u> pressure <u>gradient</u>; and

f) repeating steps b)-e) to produce a plurality of hard disc drives each having a substantially uniform resonance spectrum.

34a. (New) The method of claim 34 wherein the monitored pressure includes the pressure at an end-of-fill point in the cavity.

39. (Currently amended) The method of claim 34 wherein said set of hard disc drive components comprises a stator [[, voice coil motor]] and a base plate.

40. (Currently amended) The method of claim 34 wherein said plurality of said hard disc drive component sets comprise at least one hundred component sets <u>with phase change material thereon</u>, said at least one hundred component sets having a median first order frequency and wherein each of said at least one hundred hard disc drive component sets with a phase change material thereon has a first order frequency that is within about three hundred Hertz of said median first order frequency.

45. (Currently amended) The method of claim [[34]] 35 wherein said set of hard disc drive components are unitized by said monolithic body.

46. (Currently amended) A method for injection molding a layer of phase change material around a surface of [[each of]] a [[plurality of identical]] motor [[components]] component comprising:

a) providing a [[plurality of identical]] motor [[components]] component;

b) placing [[one of]] said [[plurality of identical]] motor [[components]] component in a mold cavity of an injection molding machine having a controllable fill rate and a controllable injection pressure;

c) closing said mold cavity;

d) injecting a molten phase change material into said mold cavity at a fill rate and injection pressure;

e) monitoring and controlling pressure in the mold cavity during the injection of the molten phase change material; and

f) controlling [[either]] the fill [[rate or injection pressure or both]] of said molten phase change material during the injection of the molten phase change using a valve gate to obtain said motor component with the phase change material thereon[[; and

g) repeating steps b)-f) to produce said plurality of motor components each having a substantially uniform resonance spectrum]].

47. (Currently amended) The method of claim 46 wherein the pressure is monitored at [[an injection to the mold cavity,]] a beginning-of-fill point and an end-of-fill point.

53. (Currently amended) The method of claim 46 wherein said plurality of said motor components comprise at least one hundred components with

phase change material thereon, said at least one hundred components having a median first order frequency and wherein each of said at least one hundred motor components with a phase change material thereon has a first order frequency that is within about three hundred Hertz of said median first order frequency.

58. (Currently amended) The method of claim [[1]] 46 wherein the phase change material has a coefficient of linear thermal expansion of less than $2x10^{-5}$ in/in/°F throughout the range of 0°F to 250°F.

59. (Currently amended) The method of claim [[1]] 46 wherein the phase change material has a coefficient of linear thermal expansion in the X, Y and Z directions, wherein the coefficient of linear thermal expansion is lowest in the X direction, and wherein the coefficient of linear thermal expansion in the Y and Z directions is no more than four times the coefficient of linear thermal expansion in the X direction.

60. (Currently amended) A method of reducing sympathetic system wide resonances of components in a hard disc drive comprising:

a) providing a hard disc drive component;

b) determining a desired resonance spectrum of said hard disc drive component;

c) placing said hard disc drive component in a mold cavity of an injection molding machine having a controllable fill rate and a controllable injection pressure;

d) closing said mold cavity;

e) injecting a molten phase change material into said mold cavity at a fill rate and an injection pressure;

f) monitoring and controlling the pressure in the mold cavity; and

g) monitoring and controlling the fill rate of said molten phase change material and injection pressure to obtain said hard disc drive component with the phase change material thereon, having said desired resonance spectrum.

62. (Original) A method for injection molding a layer of phase change material around a surface of a plurality of identical hard disc drive components comprising:

a) providing a plurality of hard disc drive components;

b) placing one of said plurality of hard disc drive components in a mold cavity of an injection molding machine having a controllable fill rate and a controllable injection pressure;

c) closing said mold cavity;

d) injecting a molten phase change material into said mold cavity at desired fill rates and injection pressures;

e) monitoring pressure in the mold cavity;

f) controlling the injection pressure of said molten phase change material to obtain said hard disc drive component with the phase change material thereon having a reproducible resonance spectrum; and

g) repeating steps b)-f) to produce said plurality of components each having a substantially uniform resonance spectrum.

63. (Currently amended) The method of claim 62 wherein the pressure is monitored at [[a runner to the mold cavity,]] a beginning-of-fill point and an end-of-fill point.

67. (Currently amended) The method of claim 62 wherein said plurality of said hard disc drive components comprise at least one hundred components with phase change material thereon, said at least one hundred components having a median first order frequency and wherein each of said at least one hundred hard disc drive components with a

phase change material thereon has a first order frequency that is within about three hundred Hertz of said median first order frequency.

73. (Currently amended) The method of claim [[1]] 62 wherein the phase change material has a coefficient of linear thermal expansion in the X, Y and Z directions, wherein the coefficient of linear thermal expansion is lowest in the X direction, and wherein the coefficient of linear thermal expansion in the Y and Z directions is no more than four times the coefficient of linear thermal expansion in the X direction.

74. (Original) A method of injection molding hard disc drive components having a reproducible resonance spectrum comprising:

a) providing at least one hundred identical hard disc drive components; and

b) over-molding a monolithic body of phase change material on a surface of said hard disc drive components using an injection molding process, wherein said components with a phase change material thereon have a median first order frequency and wherein each of said at least one hundred hard disc drive components with a phase change material thereon has a first order frequency that is within about one hundred Hertz of said median first order frequency.

75. (Original) A method of injection molding hard disc drive components having a reproducible resonance spectrum comprising:

c) providing at least one hundred identical hard disc drive components, wherein each of said components has a resonance spectrum; and

d) over-molding a monolithic body of phase change material on a surface of said hard disc drive components using an injection molding process, wherein the resonance spectra of said at least one hundred hard disc drive components with phase change material thereon have a standard deviation of first order resonance frequency that is at least about fifty percent less than the

standard deviation of first order resonance frequency for the same number of the same components over-molded with an injection molding process wherein only injection pressure and either injection time or stroke of an extrusion screw are controlled.

76. (New) A method of manufacturing motors having a reproducible resonance spectrum comprising:

a) providing a plurality of identical motor component sets, wherein each of said sets consists of components that are used in a single motor;

b) placing and positioning one of said plurality of motor component sets in a mold cavity of an injection molding machine;

c) closing said mold cavity;

d) monitoring the pressure inside the mold cavity;

e) injecting a molten phase change material into said mold cavity to a pre-determined cavity pressure gradient; and

f) repeating steps b)-e) to produce a plurality of motors each having a substantially uniform resonance spectrum.